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(71) Applicant
United Kingdom Atomic Authority

(Incorporated in the United Kingdom)

11 Charles II Street, London, SW1Y 4QP, United Kingdom

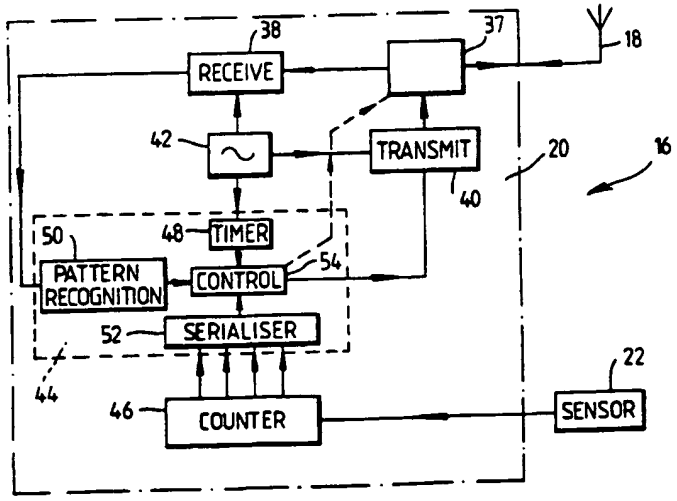
(72) Inventors
Michael Hughes Butterfield
Andrew Hopkinson

(74) Agent and/or Address for Service
Peter Turquand Mansfield
United Kingdom Atomic Energy Authority, Patents Branch, B329 Harwell Laboratory, Oxfordshire, OX11 0RA, United Kingdom

(54) Telemetry transponder

(57) A transponder (16), for use with a utility meter such as a domestic electricity meter, incorporates a sensor (22) providing electrical pulses representing operation of the meter (12) which are supplied to a mechanical counter (46). The transponder (16) also incorporates an aerial (18), a radio wave receiver (38) and a transmitter (40), and a control unit (44). In response to receipt of a sequence of binary digits transmitted by a base station (vehicle) and recognised by a pattern recognition unit (50), the transmitter (40) transmits a signal corresponding to the data stored by the counter (46); the transmission occurs after a time delay set by a timer (48) to be different for all the transponders (16) in a given area. This ensures the transponders transmit in sequence and not simultaneously.

Fig. 2.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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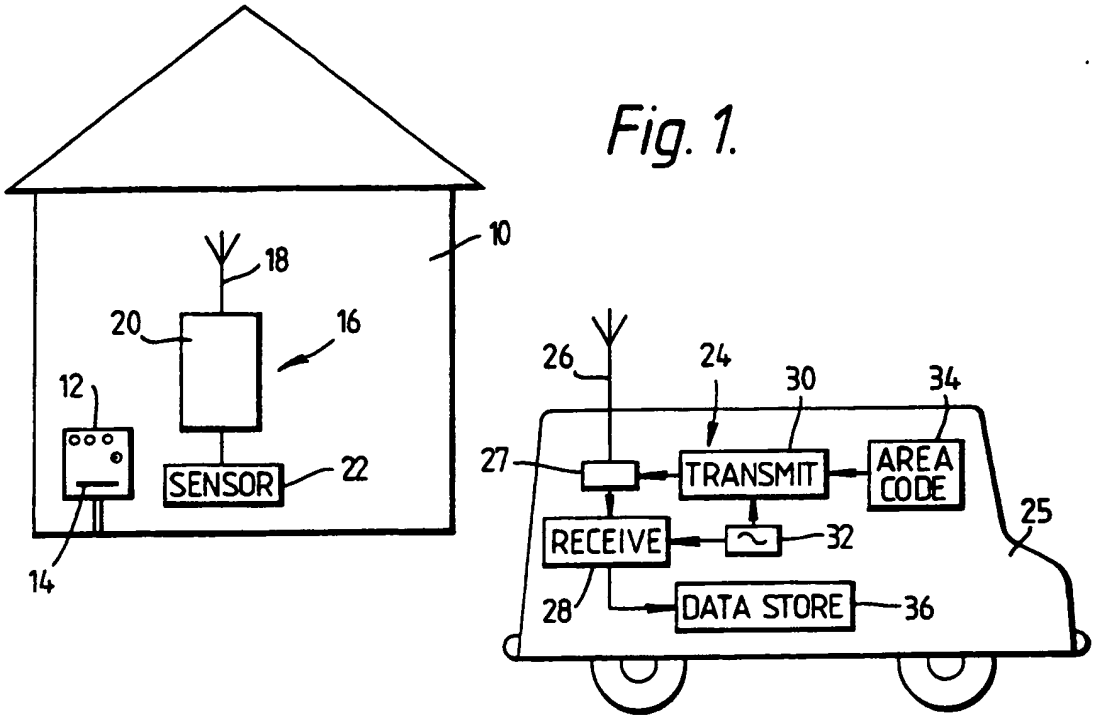
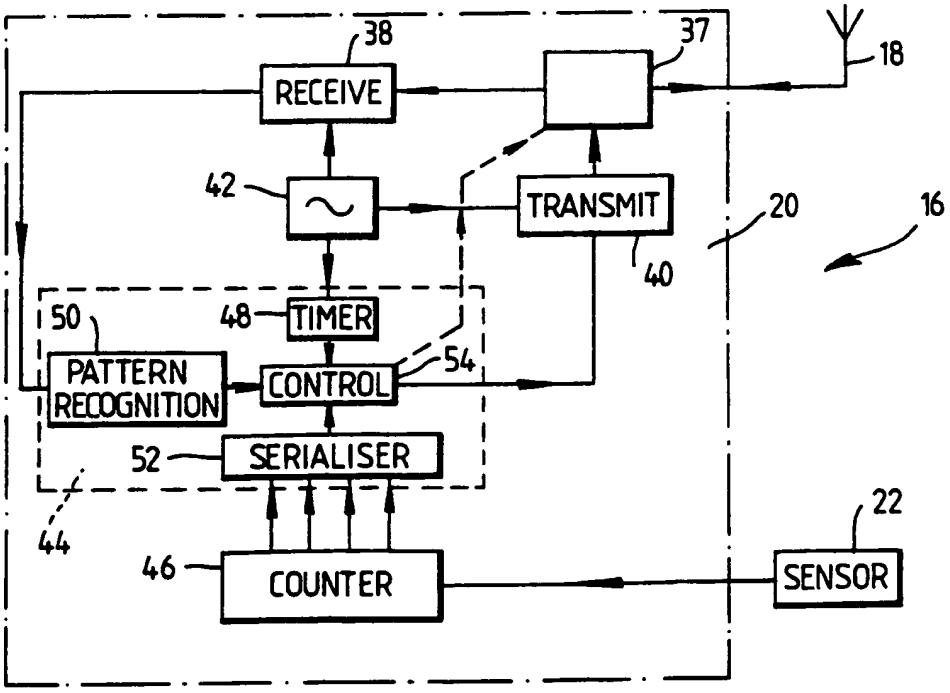

10
18
20
16
12
SENSOR
22
14
26
24
30
34
27
TRANSMIT
AREA CODE
25
RECEIVE
32
28
DATA STORE
36

Fig. 1.

Fig. 2.


38
37
18
RECEIVE
42
TRANSMIT
20
16
40
50
48
TIMER
PATTERN RECOGNITION
CONTROL
54
52
SERIALISER
44
22
46
COUNTER
SENSOR

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Telemetry Transponder

The invention relates to an apparatus and a method for the remote reading of data measured by an instrument.

Commodities such as electricity and gas are conventionally metered by an instrument located at the consumer's factory or residence. Such meters have to be read at intervals for the utility to know how much has been consumed, and so to be able to charge the appropriate amount; a considerable amount of employee time is required to obtain meter readings. Hence a telemetry system which would enable meters to be read remotely has been seen as advantageous. Remote reading systems where data is transmitted as signals on telephone lines or on electric power cables have been proposed but do not appear to be economic.

According to the present invention there is provided a transponder for use with a meter, the transponder incorporating a memory to record consumption of a quantity measured by the meter, the memory being arranged to be supplied with signals indicating the consumption as measured by the meter, and arranged to provide an output representing the total consumption, the data stored by the memory being unaffected by any loss of power supply to the memory, the transponder also incorporating a receiver for radio signals, pattern recognition means to respond to a pattern of received radio signals, a transmitter arranged to be activated in response to the pattern recognition means and, when activated, to transmit radio signals representing the output of the memory, and a clock means arranged to set a time interval between receipt of the said pattern and activation of the transmitter, the time interval being preset for a particular transponder and different for different transponders installed in an area.

The preferred memory is a mechanical counter which ensures the stored data is not lost if there is a loss of power. The signals indicating consumption may be generated by the meter itself, or the transponder may also incorporate means responsive to operation of the meter to generate such signals. For example, for use with an electricity meter which incorporates a rotating disc, the transponder might incorporate an optical or infra-red sensor to detect each rotation of the disc.

Preferably the pattern of signals to be recognised is the same for several transponders installed in an area, whereas the time intervals for all those transponders are different. Consequently a single broadcast of the pattern by a base station causes all those transponders to respond, the transmitters being activated in a sequence so that no two transmit simultaneously. Desirably each transmitter, when activated, transmits radio signals which identifies the transponder, as well as signals representing the memory output signals. The identifying signal may be a number proportional to the corresponding time interval for that transponder.

The invention will now be further described, by way of example only, and with reference to the accompanying drawings, in which:

Figure 1 shows a diagrammatic view of a remote meter reading system incorporating a transponder and a mobile base station; and

Figure 2 shows a block diagram of the transponder of Figure 1.

Referring to Figure 1 there is represented a house 10 in which is a domestic electricity meter 12 with a

rotating disc 14. A transponder unit 16 (not to scale) comprises an aerial 18, an electronics module 20, and an optical sensor 22 arranged adjacent to the disc 14, the sensor 22 providing a pulse to the module 20 for every complete rotation of the disc 14. (Many currently used meters already have provision for an electrical output providing such a pulse.)

A mobile base station 24 is provided in a vehicle 25. This comprises an aerial 26 connected via a switch-over unit 27 to a receiver 28 and a transmitter 30, each of which is connected to a 420 MHz oscillator 32. The transmitter 30 is connected to a digital signal pattern generator 34 so that when activated a sequence of binary digits is transmitted; this sequence of digits identifies a particular group of transponder units 16, for example all those in a certain area. The receiver 28 is connected to a data store 36, so when signals are received, identifying particular transponders 16 and the electricity consumption detected by each, this information is recorded for later analysis.

Referring to Figure 2, this shows a block diagram of the transponder 16, the electronics module 20 being shown in greater detail than in Figure 1. The aerial 18 is connected via a switch-over unit 37 to a receiver 38 and to a transmitter 40, each of which is connected to a 420 MHz oscillator 42. The transmitter 40 is connected to a control unit 44 (indicated by the block outlined with a broken line) consisting of an integrated circuit and/or wired circuitry, to which the receiver 38 is also connected. The pulses from the optical sensor 22 are supplied to a mechanical counter 46 which has twelve contact closure outputs (only four are shown), which are all connected to the control unit 44. The unit 44 incorporates four sub-units: a timer 48 which receives a

signal from the oscillator 42; a pattern recognition unit 50 which receives signals from the receiver 38; a serialiser unit 52 to which the outputs of the counter 46 are connected; and an output control unit 54 which provides signals to the transmitter 40.

Before installation, the transponder 16 is programmed with an identifying binary number with twelve digits; the first four digits are the same for all the transponders 16 in a particular area, whereas the next eight digits identify uniquely one transponder 16 in that area. The programming is done by cutting appropriate wires in a set of twelve earth connections initially made to the pattern recognition unit 50, so the cut wires each represent the digit one and the uncut wires the digit zero.

In operation, when it is desired to read all the electricity meters in the area, the vehicle 25 travels to a point within transmission distance of all the transponders 16 (within a mile for example), and the transmitter 30 is energised to transmit the four digit binary code for that area. The unit 27 is then switched to the receiver 28.

At all the transponders 16 the switching unit 37 is usually switched to the receiver 38, so the four digit code will be supplied to the pattern recognition unit 50 of the control unit 44. Since this code is the same as the first four digits programmed into the transponder 16, the pattern recognition unit supplies a signal to the output control unit 54 to initiate transmission of data. Consequently the unit 37 is switched to the transmitter 40; the timer 48 is started to time an interval proportional to the unique eight-digit binary number identifying that transponder 16; and the serialiser unit 52 generates a binary number corresponding to the contact closure outputs of the counter 46. When the time interval has elapsed, the transmitter 40

is activated to transmit a sequence of binary digits consisting first of the twelve digits identifying the area and the transponder 16, and then the twelve digits indicating the data stored by the counter 46.

The data store 36 in the vehicle 25 thus records the consumption of electricity by each meter 12 in the area. This can subsequently be down-loaded into the billing computer of the electricity company; it may for example be stored on floppy discs.

It should be understood that the radio frequency for transmission from the base station 24 may be different from that for transmission from the transponder 16, so that in each case separate oscillators would be required for transmission and for reception, instead of the common oscillators 32 and 42. It will be appreciated that the transmitters 30 and 40 might transmit AM and FM signals respectively, or vice versa. This ensures that the transponders 16 in an area are not accidentally activated to transmit by a data transmission from a transponder 16 in an adjacent area.

It will also be understood that the identifying number might be programmed into the transponder 16 in a manner different to that described above, for example by means of an EPROM unit in the control unit 44. The number of digits in the identifying number might differ from that described above. Furthermore the four digit code might not be the same for all the transponders 16 in a given geographical area; for example one code might represent all the domestic meters 12, and a different code all the industrial meters 12. It will also be appreciated that the constant of proportionality between the time interval set by the timer 48 and the unique identifying number of the transponder 16

must be sufficiently long to allow each transponder 16 to transmit the requisite number of digits, and so ensure no two transponders 16 are transmitting simultaneously; if the transponder 16 is also required to transmit any further data, for example to indicate if it has been tampered with, or for example to indicate the peak consumption rate, then the time allowed for each transponder 16 to transmit will have to be increased accordingly. A single transponder 16 might be used to transmit data from several different meters at one location, the transponder incorporating separate sensors 22 (where necessary) and separate counters 46 for the data from each meter.

Claims

1. A transponder for use with a meter, the transponder incorporating a memory to record consumption of a quantity measured by the meter, the memory being arranged to be supplied with signals indicating the consumption as measured by the meter, and arranged to provide an output representing the total consumption, the data stored by the memory being unaffected by any loss of power supply to the memory, the transponder also incorporating a receiver for radio signals, pattern recognition means to respond to a pattern of received radio signals, a transmitter arranged to be activated in response to the pattern recognition means and, when activated, to transmit radio signals representing the output of the memory, and a clock means arranged to set a time interval between receipt of the said pattern and activation of the transmitter, the time interval being preset for a particular transponder and different for different transponders installed in an area.

2. A transponder for use with a meter, substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

Agents

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